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THIRD QUARTERLY REPORT
R-310.3-53, PIB-249.3

on

MEASUREMENT OF RADIO FREQUENCY CABLE

May 1, 1953 to July 31, 1953

for
BUREAU OF SHIPS
Contract NObsr-63084
Index No. NE-111616, Subtask 10

MRI

POLYTECHNIC INSTITUTE OF BROOKLYN
MICROWAVE RESEARCH INSTITUTE

[redacted]

Microwave Research Institute
Polytechnic Institute of Brooklyn
55 Johnson Street
Brooklyn 1, New York

Report R-310.3-53, PIB-249.3
Contract No. NObsr-63084
Index No. NE-111616
Subtask 10

Third Quarterly Report

on

MEASUREMENT OF RADIO FREQUENCY CABLE

May 1, 1953 to July 31, 1953

Prepared under Contract NObsr-63084

for

Bureau of Ships

6/21/54

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Associate Director

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Saul W. Rosenthal
Research Associate

Approved: Ernst Weber
Ernst Weber
Director

Title Page
Abstract
3 Pages of Text
1 Table
8 Pages of Figures

Brooklyn 1, New York
September 17, 1953

ABSTRACT

An outline is given of the work being done in the program consisting of radio frequency cables and the evaluation of cable construction as it affects its attenuation and leakage. Results of the first set of measurements are given for the frequency range of 2500 to 10,000 mc/sec and some curves compared with existing data. Plans for implementing the program are discussed. The emphasis is placed on frequencies between 2500 and 10,000 mc/sec where anomalous attenuation behavior has been experienced.

I. Introduction

The purpose of this contract is to conduct a measurements program on the attenuation and leakage parameters of cables over a frequency range of from 100 to 10,000 mc/sec. These measurements will bring up to date the attenuation specifications of available cables listed in the publication, "Attenuation of Standard RF Cables", Bureau of Ships, Code 817, dated May 1952 and where possible extend the frequency range to 10,000 mc/sec. The program will also include a limited investigation of attenuation in the region of 3000 to 10,000 mc/sec as a function of cable construction.

The first set of cable measurements has been completed over the frequency range of 2500 mc/sec to 10,000 mc/sec. The curves for these cables are compared to existing data and the results discussed. New cables that have been received in the interim have been prepared for testing and are currently being measured over the same frequency range as the previous set. The special cables needed for the evaluation of cable construction as it affects attenuation above 3000 mc/sec have been ordered and should be received in the near future. As soon as they are received, measurements will be initiated. In addition, discussions are being held with a view towards conducting leakage measurements on these special cables. Reports describing the attenuation measurements that resulted in the publication noted above are being studied.

II. Work in Progress

A. Procurement of Test Samples

The total number of sample cables so far received have been the following:

1.	RG-5A/U*	350 ft.
2.	RG-9A/U*	350 ft.
3.	RG-10A/U**	521 ft.
4.	RG-21/U*	200 ft.
5.	RG-116/U*	143 ft.
6.	RG-118/U	500 ft.
7.	RG-11/U*	250 ft.
8.	RG-85/U	300 ft.
9.	RG-20/U	500 ft.
10.	RG-34/U**	550 ft.
11.	RG-18/U**	350 ft.
12.	RG-141/U**	200 ft.

*Sample cable used in first set of cables measured.

**Sample cable used in second set of cables to be measured.

Additional cable samples purchased by Polytechnic Institute of Brooklyn in order to expedite the measurements program:

13.	RG-58A/U*	200 ft.
14.	RG-8/U**	300 ft.
15.	RG 55/U**	300 ft.

The special cables listed in the preceding report have been ordered and shipment is expected in the near future.

B. Procurement of Connectors

Connectors and adapters have been obtained for most of the cables involved in the measurement program. Additional ones are on order and should arrive shortly.

C. Measurement Program

Measurements on the first group of cables (6) were completed over the frequency range of 2500 to 10,000 mc/sec. This group included the following cables:

Cable Type	Total Length	Connectors Used	Nominal Impedance
1. RG-5A/U	350 ft.	UG-18C/U, UG-20C/U	50.0
2. RG-9A/U	350 ft.	UG-21D/U, UG-23D/U	51.0
3. RG-21/U	200 ft.	UG-18C/U, UG-20C/U	53.0
4. RG-116/U	143 ft. 10 in.	UG-21D/U, UG-23D/U	50.0
5. RG-11/U	250 ft.	UG-21D/U, UG-23/U***	75.0
6. RG-58A/U	200 ft.	UG-88/U, UG-89/U	52.0

The cables were measured as described in the first and second reports using equipment as shown in Fig. MRI-13097 and MRI-13096. For each of the methods used three or more readings were taken on each sample and the final value was taken as the average of all samples of each type tested. It should be emphasized that as the attenuation increased with frequency it was necessary to use smaller and smaller sample lengths. For very high attenuation and very small sample lengths, the attenuation becomes very critical and any variation in cable curvature would seriously affect the readings. This together with the connector problem at higher frequencies made it difficult in some cases to get reliable attenuation values at frequencies around 10,000 mc/sec. In the case of RG-11/U it was impossible to obtain values at 9000 and 10,000 mc/sec since the slightest movement of the cable threw the readings off.

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*Sample cable used in first set of cables measured.

**Sample cable used in second set of cables to be measured.

***Special UG-21D/U and 23D/U connectors designed for 75 ohms.

The results of the measurements are tabulated in Table I and curves of attenuation vs. frequency are given from the same data in Fig. MRI-13521 thru MRI-13526.

Of the six cables measured only RG-5A/U and RG-9A/U have data out to 10,000 mc/sec and so in those cases, it is possible to compare results. In the case of RG-9A/U cable both the MRI curve and the curve on the chart seem to agree fairly well to within the experimental error. However, in the case of RG-5A/U, the attenuation values on the chart were, on the average, higher by about a 5db/100 ft. over the entire frequency range measured. The slopes of the curves were approximately the same and the difference in value is probably due to the variation in cables as a result of manufacturer, batch, age, etc.

A second set of six (6) cables have been assembled and are being prepared from the series of measurements.The group consists of the following cables:

Cable Type	Total Length	Connectors Used	Nominal Impedance
7. RG-8/U	300 ft.	UG-21D, UG-23D	52.0
8. RG-10/U	521 ft.	UG-21D, UG-23D	52.0
9. RG-55/U	300 ft.	UG-88/U,UG-89/U	53.5
10.RG-18/U	350 ft.	UG-167A/U	52.0
11.RG-141/U	200 ft.	UG-88/U, UG-89/U	50.0
12.RG-34/U	550 ft.	(83-21SP, 83-21J) or special connectors	71.0

As additional cable samples are received they will be included in the above group, or if enough cables are available, the measurement program will be expedited by running two groups simultaneously.

In addition the special cables are on order and as soon as they are received, measurements on them will be initiated.

D. Study Program

The reports that have been received are currently being read and will be evaluated in terms of our present program.

E. Identification of Personnel

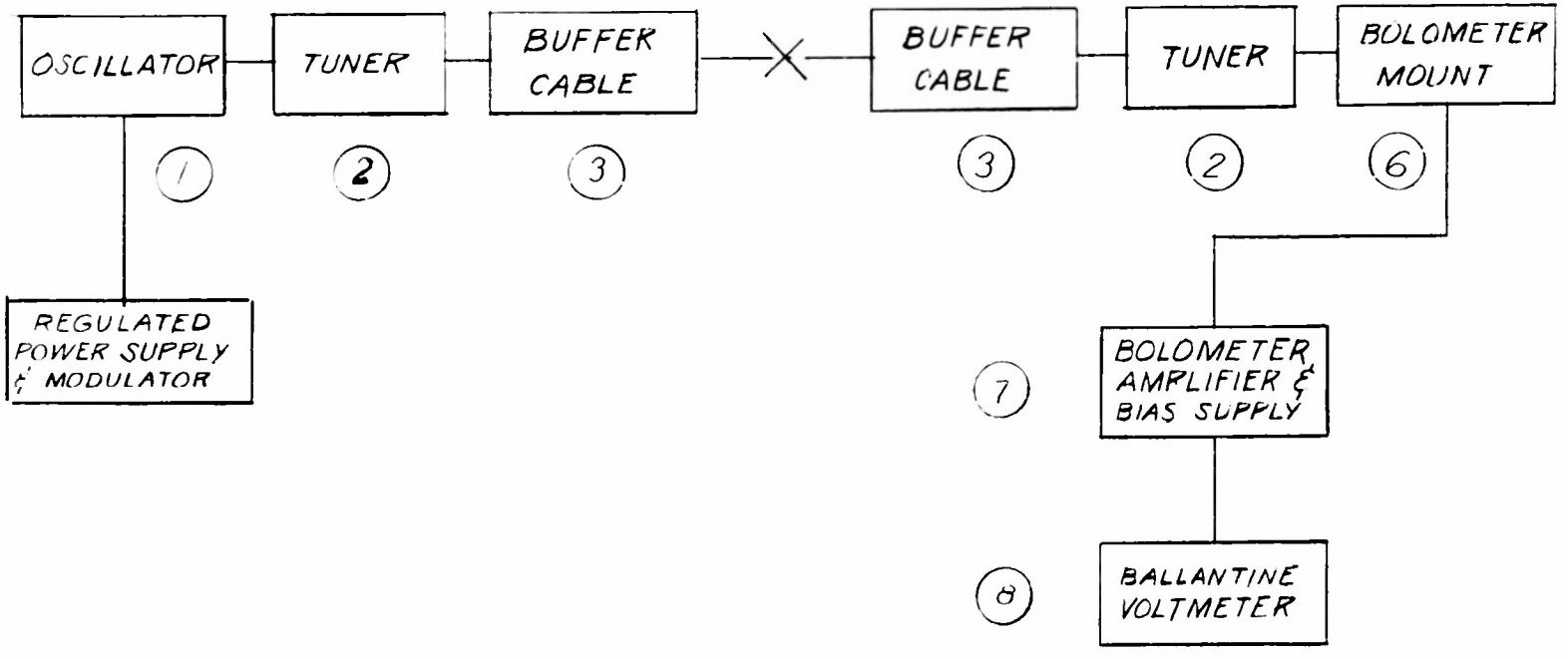
The above work is being carried out through the efforts of the following personnel:

Dr. J.W.E. Griemsmann	Associate Director	Part Time
Mr. S.W. Rosenthal	Research Associate	Part Time
Mr. W. Zeliger	Technician	Full Time

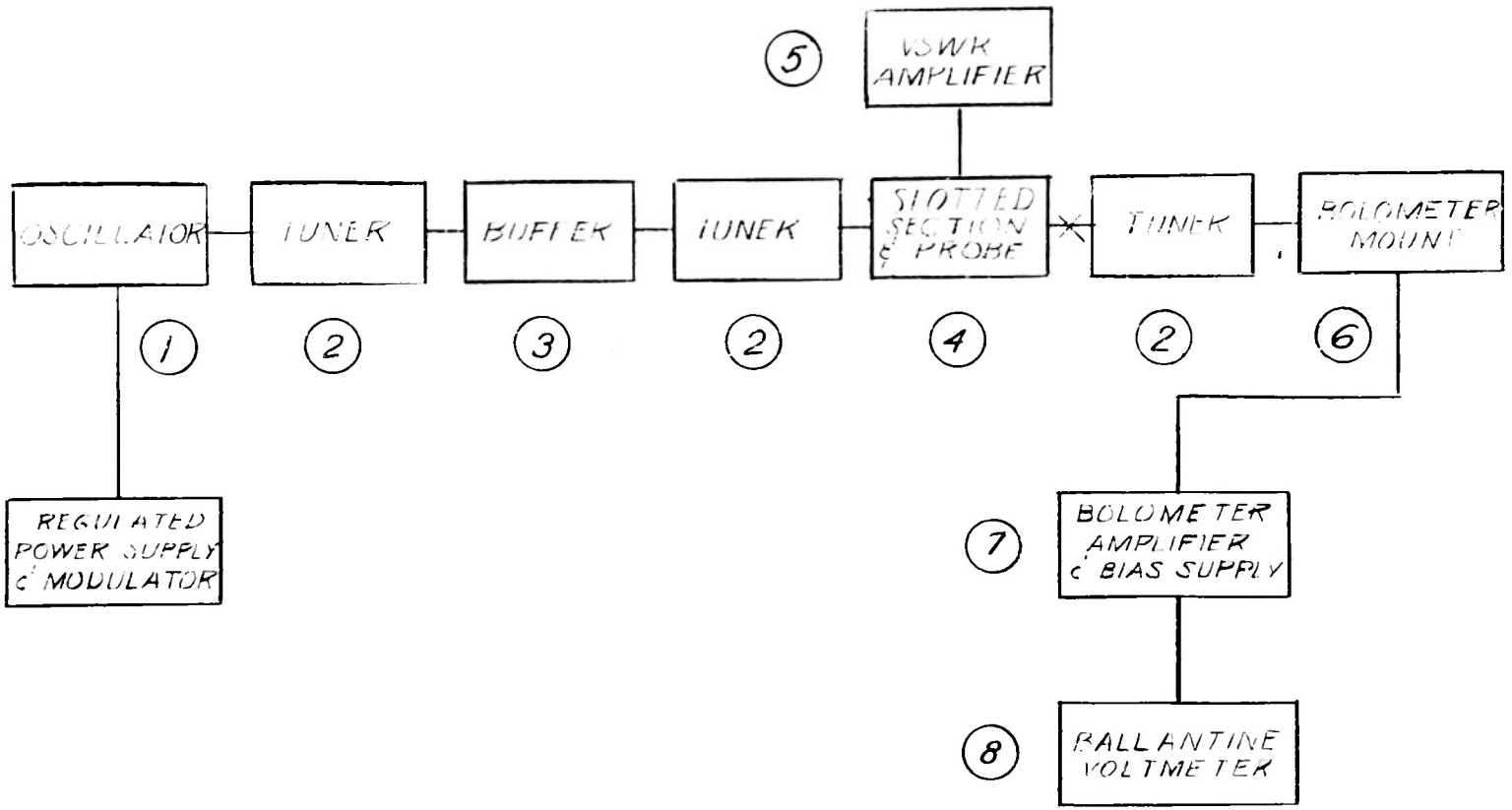
TABLE I

(Continued From Previous Progress Report)

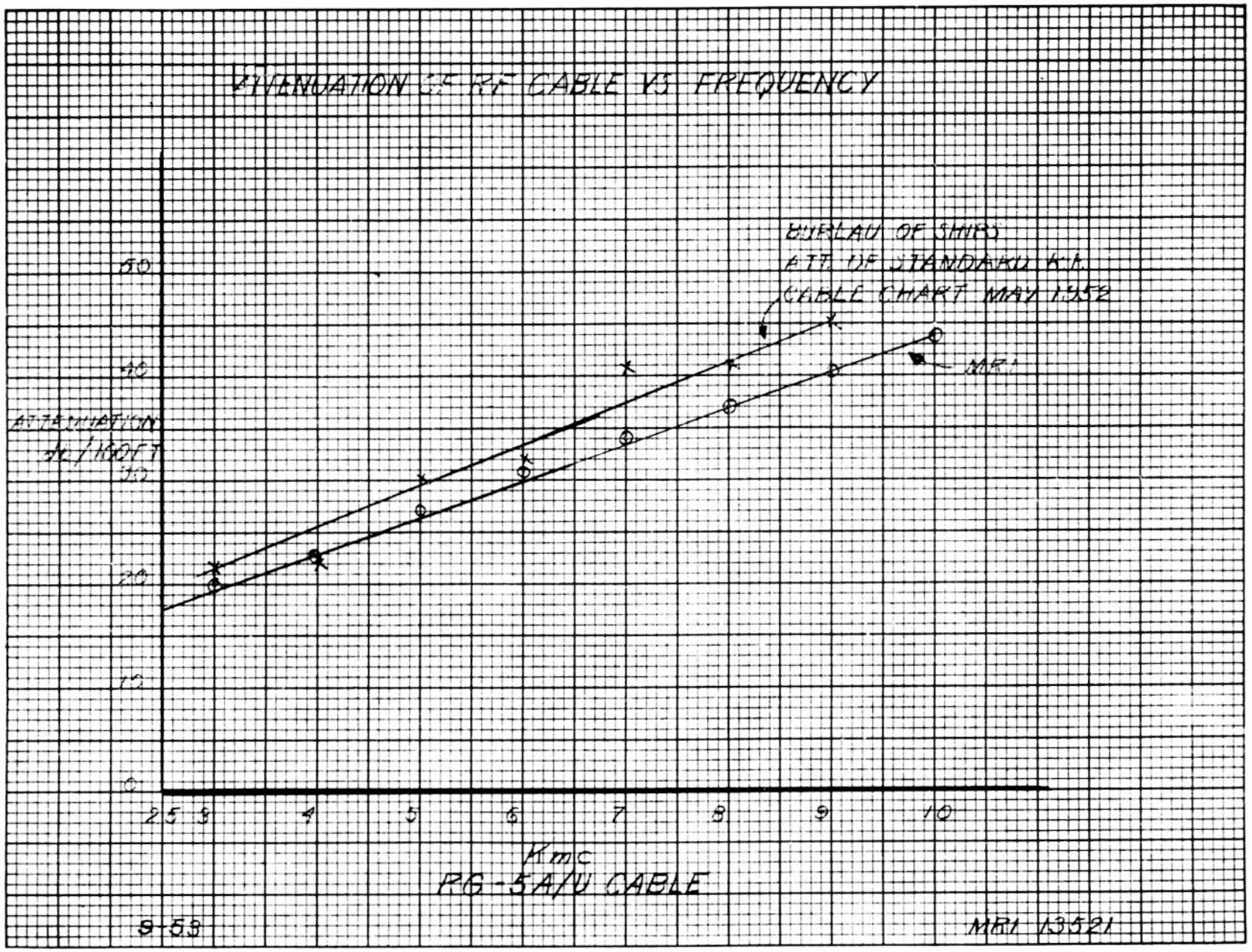
Frequency	Cable Type	Sample Lengths	Average Att/100 ft Buffer Method
5000 mc	RG-5A/U	50'; 100'	27.1
	RG-9A/U	50'; 100'	26.3
	RG-11/U	30'; 75 1/4'	31.8
	RG-21/U	15'; 25'; 12 1/2'	110.0
	RG-58A/U	30'; 40'	81.4
	RG-116/U	40'; 100'	22.5
6000 mc	5A/U	50'; 100'	30.6
	9A/U	50'; 100'	30.4
	11/U	30'; 20'	45.5
	21/U	15'; 18'	119.9
	58A/U	20'; 30'	97.2
	116/U	40'; 100'	25.9
7000 mc	5A/U	50'; 100'	33.9
	9A/U	50'; 100'	34.7
	11/U	30'; 37 1/2'	67.5
	21/U	15'; 18'	130.0
	58A/U	20'; 30'	116.2
	116/U	40'; 100'	29.2
8000 mc	5A/U	50'; 100'	36.9
	9A/U	25'; 50'	38.5
	11/U	20'; 30 1/2'	95.9
	21/U	15'; 18'	143.5
	58A/U	10'; 15'	142.2
	116/U	40'; 60'	31.6
9000 mc	5A/U	50'; 68'	40.2
	9A/U	25'; 50'	40.2
	11/U	-	-
	21/U	12 1/2'; 15'	155.0
	58A/U	10'; 15'	188.1
	116/U	60'; 60'	33.3
10,000 mc	5A/U	50'; 68'	43.2
	9A/U	25'; 50'	41.3
	11/U	-	-
	21/U	12 1/2'; 15'	171.0
	58A/U	10'; 15'	244.0
	116/U	60'; 60'	35.0

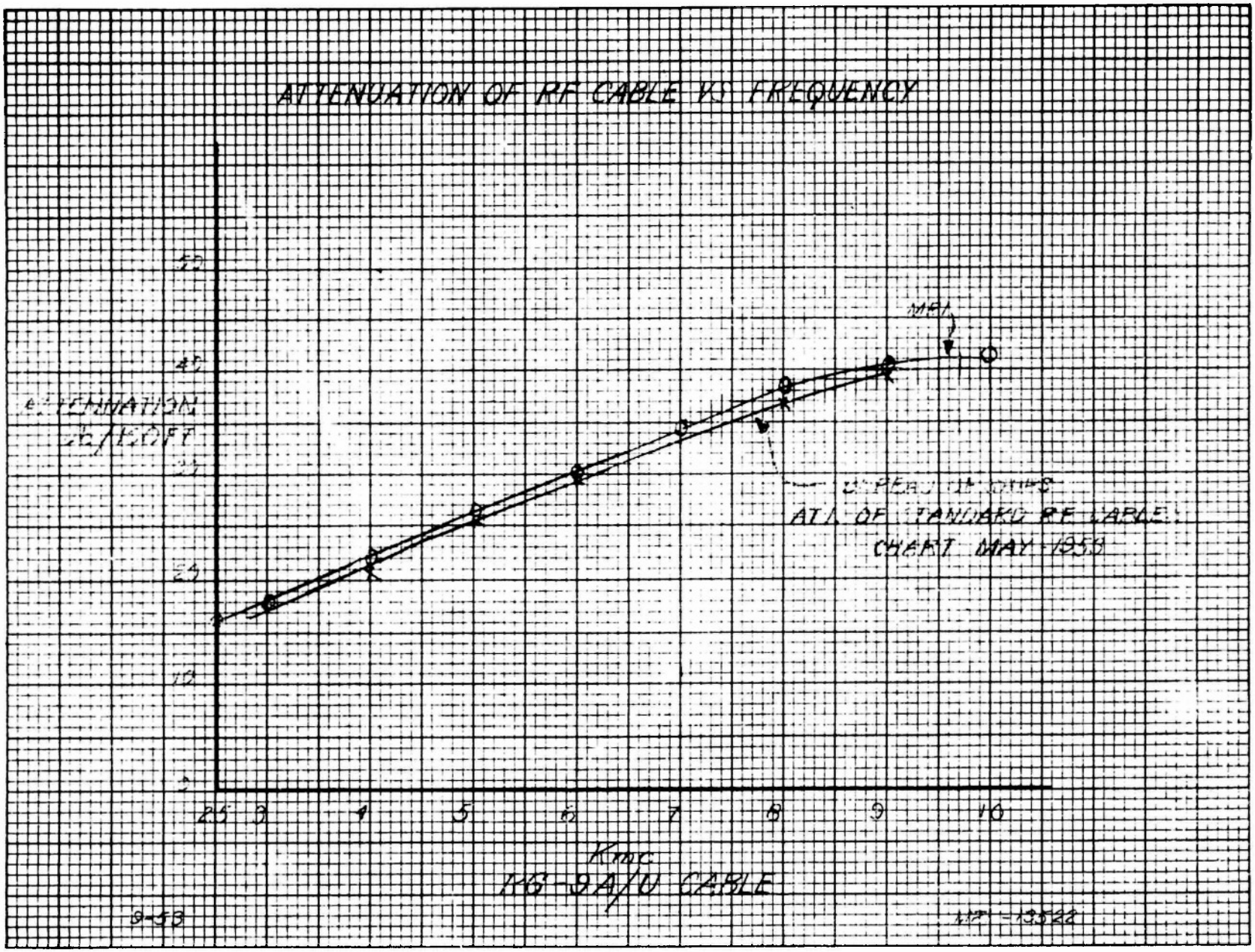


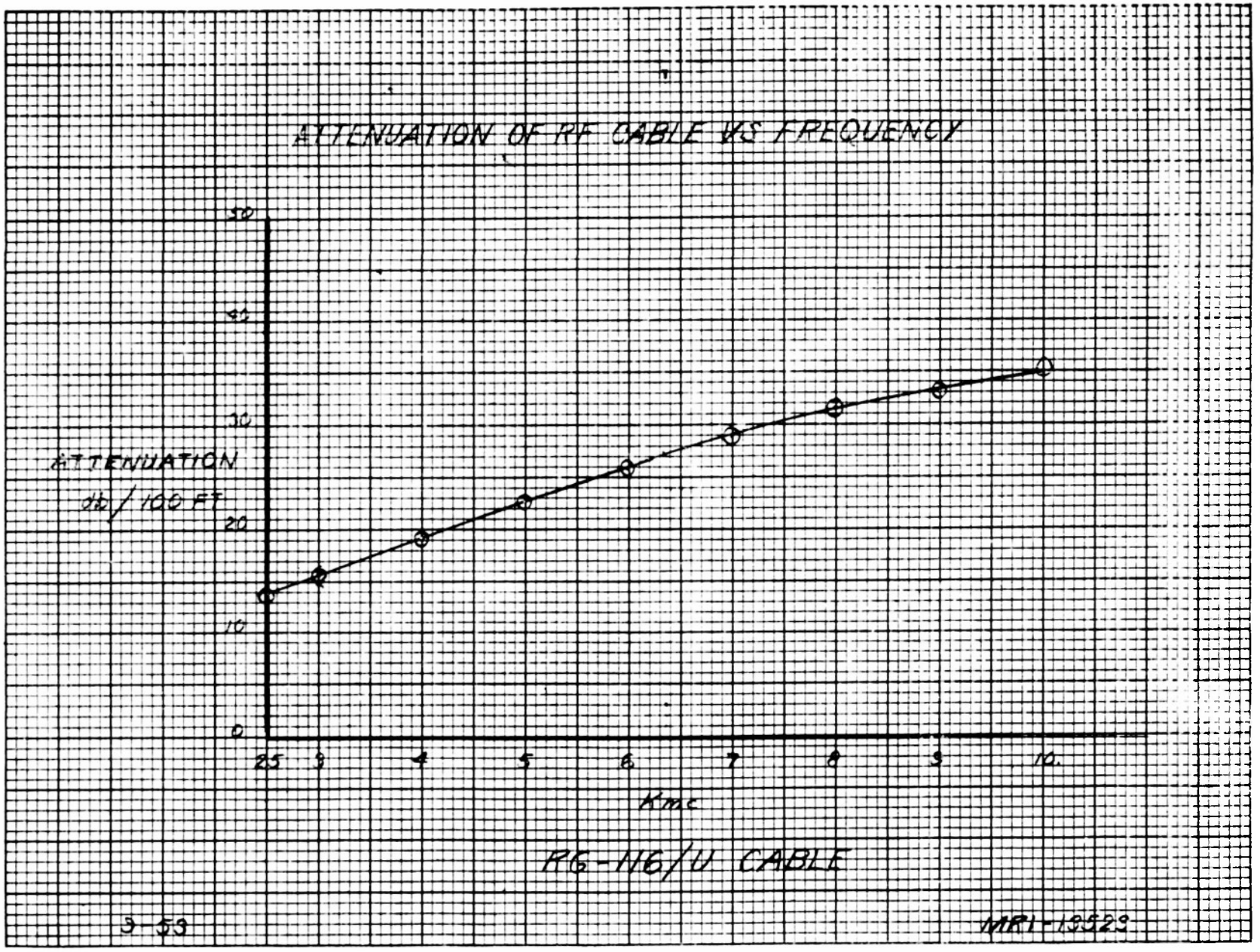
BALLANTINE VOLTMETER ATTENUATOR
MEASURING SET-UP USING BUFFER CABLES

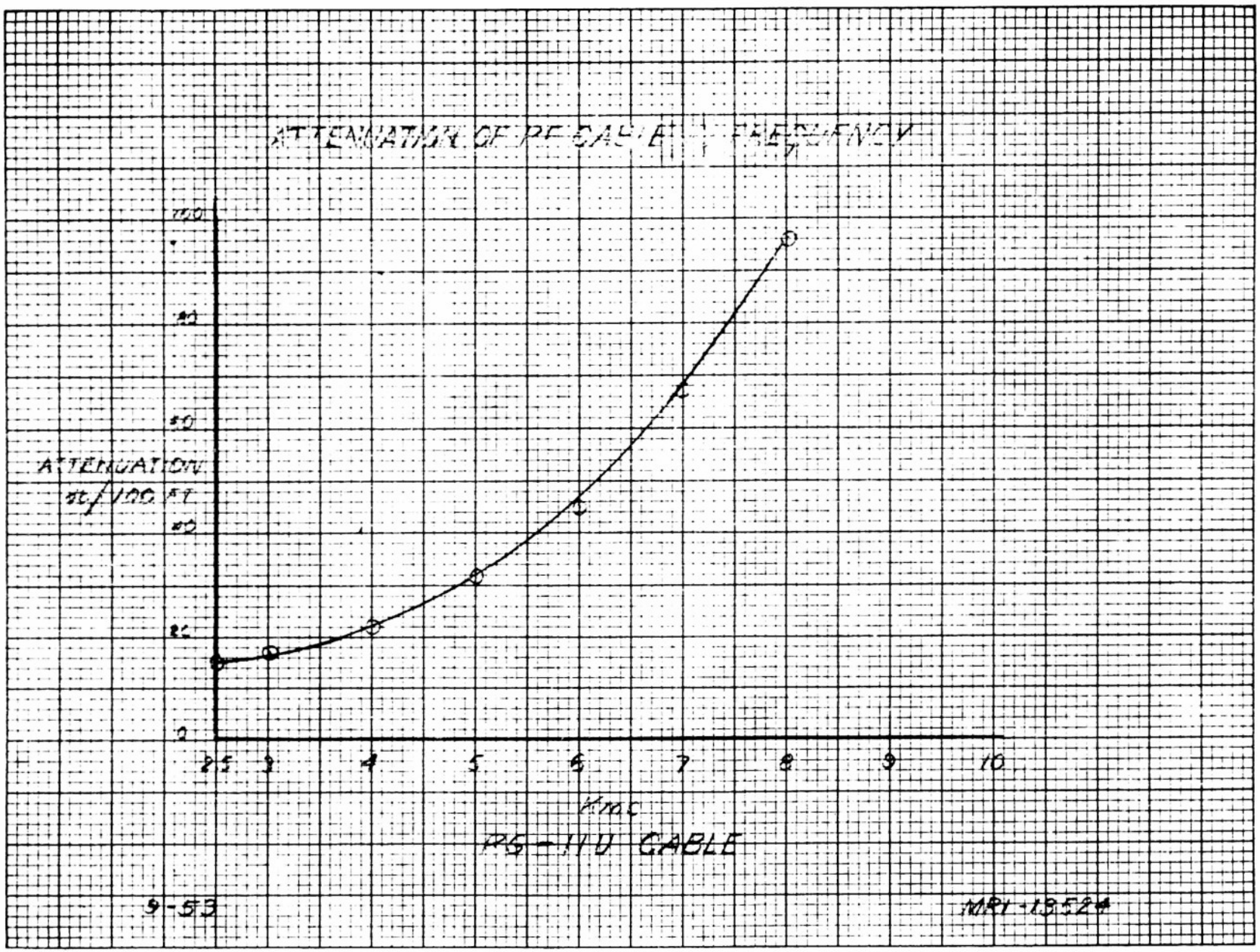


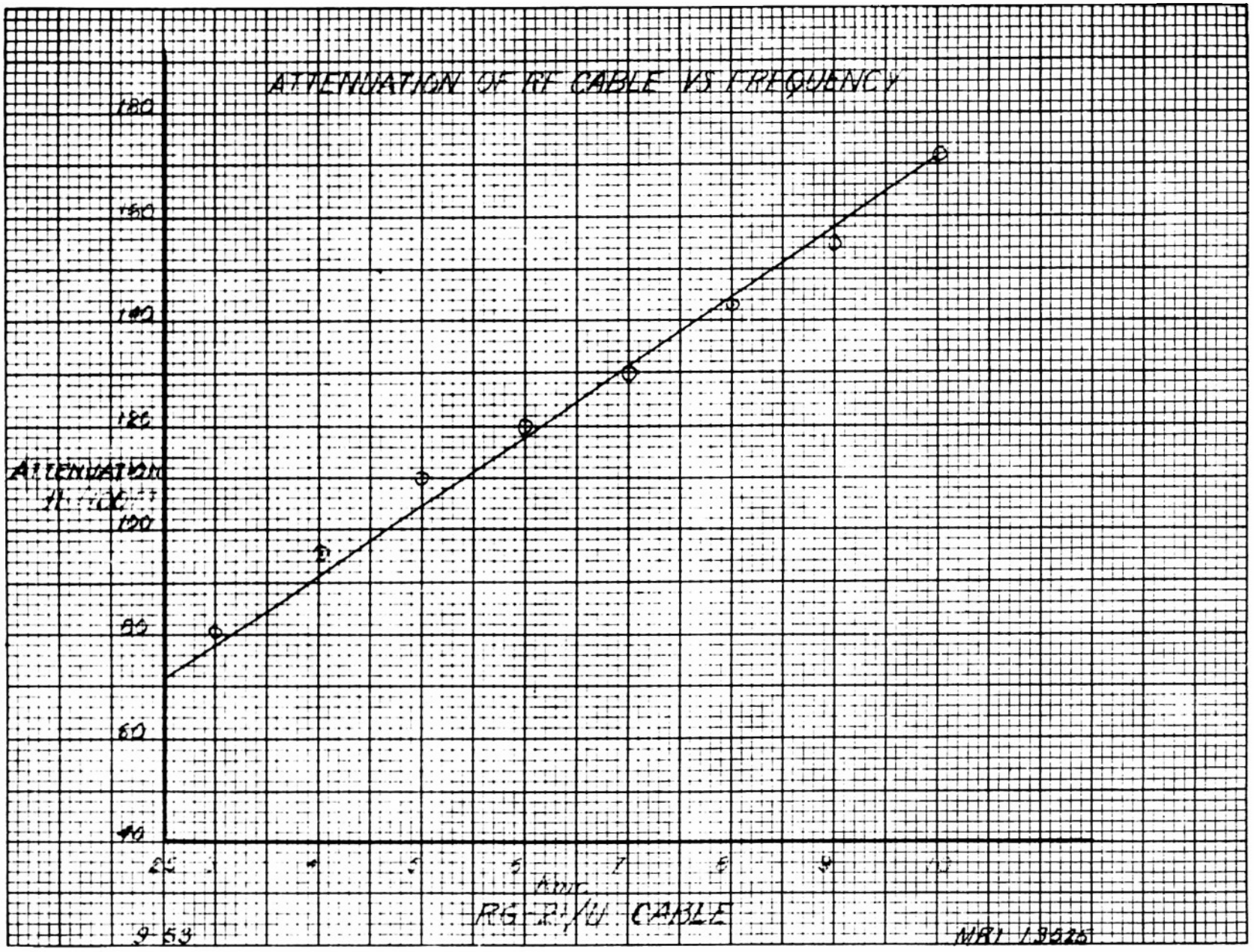
BALLANTINE VOLTMETER
ATTENUATION MEASURING SET-UP

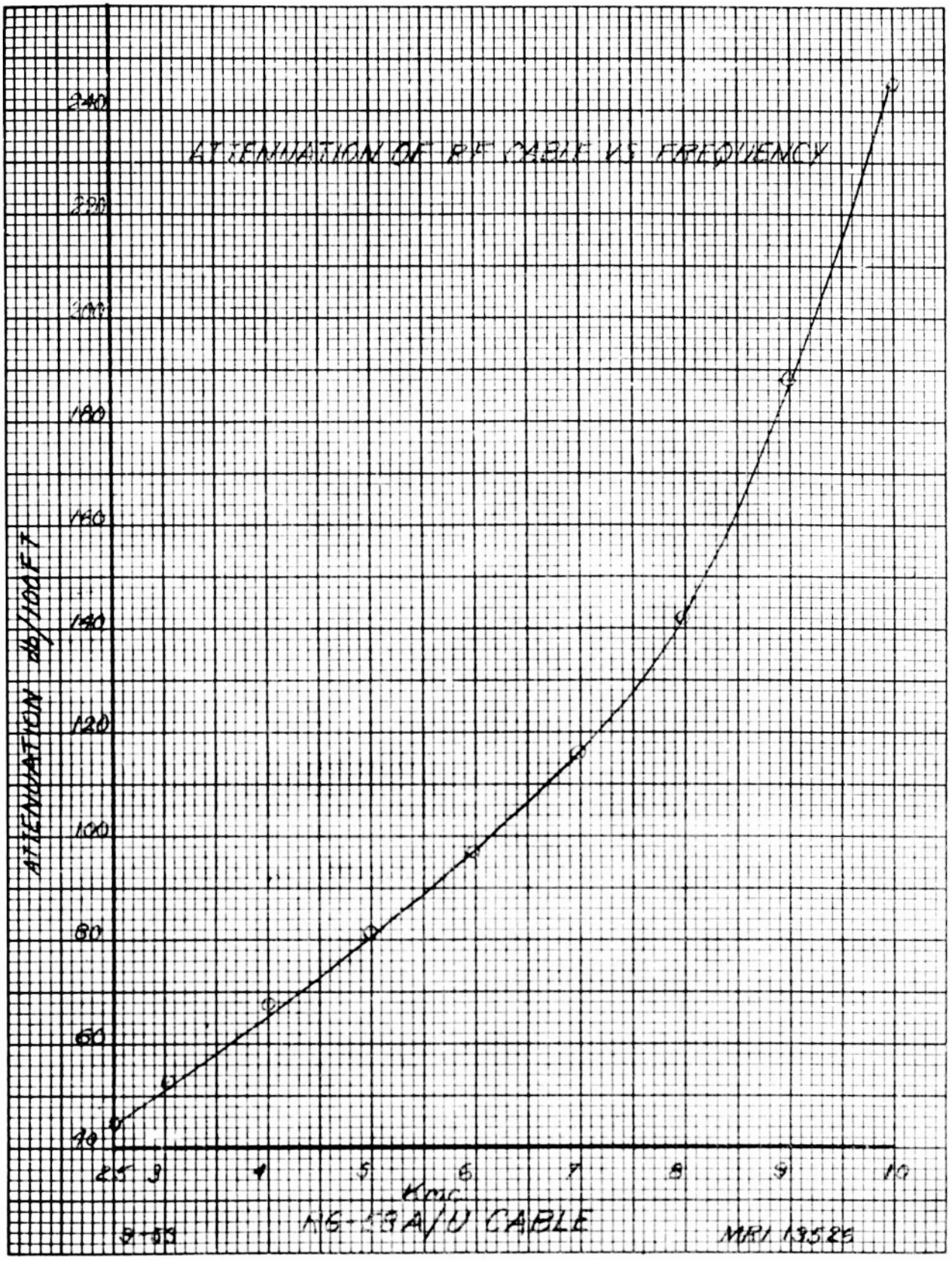

ATTENUATION OF RF CABLE VS FREQUENCY
BUREAU OF SHIPS
ATT. OF TANDARA K.L.
CABLE CHART MAY 1952
MR1
ATTENUATION
DB/100 FT
60
40
30
20
10
0
2.5
3
4
5
6
7
8
9
10
Kmc
RG-5A/U CABLE
9-53
MR1 13521


ATTENUATION OF RF CABLE VS FREQUENCY
50
40
30
20
10
2
2.5
3
4
5
6
7
8
9
10
Kmc
RG-9A/U CABLE
9-53
MP-13522


ATTENUATION OF RF CABLE VS FREQUENCY
ATTENUATION
db / 100 FT
50
40
30
20
10
0
.25
3
4
5
6
7
8
9
10.
Kmc
RG-116/U CABLE
3-53
MRI-19529


ATTENUATION OF RF CABLE VS FREQUENCY
ATTENUATION
db/100 FT
100
80
60
40
20
0
2.5
3
4
5
6
7
8
9
10
KMC
RG-11U CABLE
9-53
MRI-13524


ATTENUATION OF RF CABLE VS FREQUENCY
180
160
140
120
ATTENUATION
100
80
60
40
20
5
7
9
53
RG-8/U CABLE
MRI 13525


ATTENUATION OF RF CABLE VS FREQUENCY
ATTENUATION db/100FT
240
220
200
180
160
140
120
100
80
60
40
2.5
3
4
5
6
7
8
9
10
Kmc
RG-19A/U CABLE
MRI 19525

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